UMLS-based Access to CPR Data

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This abstract describes the results of a project that explores the use the Unified Medical Language System (UMLS) [1] in browsing a computer-based patient record (CPR) [2]. The project consisted of a number of steps: the mapping between CPR terms and UMLS concepts, the development of an algorithm that explores the CPR data using this mapping, and the implementation of a first prototype browser that visualizes "found" data. A second issue in this project has been the direct access to online medical literature (MEDLINE) using the UMLS concepts found in the CPR data. In this project, we used a preliminary version of the Open Records for Patient Care (ORCA) CPR that consisted only of the history and physical examination data of patient suffering from heart failure.

METHODS

A program has been developed (specific for ORCA) that generates a first mapping between data items in the data model of the computer-based patient record and the UMLS medical concepts. As is to be expected, many of these first mappings can either not be found as a concept in the UMLS or do not uniquely identify one single UMLS concept. The second step in this project dealt with the development of a graphical interactive program to refine this initial mapping with information from MetaMap and the UMLS Knowledge Source Server (KSS).

The algorithm filtering data in a patient record according to a set of UMLS concepts that has been implemented in the browser maps free text terms entered by the user in the term entry box to a set of UMLS concepts. These UMLS concepts are expanded with all their descendant concepts. By means of the mapping between UMLS concepts and CPR terms, the CPR terms associated with the expanded UMLS concept list are identified. Subsequently, patient data that corresponds with the identified CPR terms are retrieved, categorized bu the Metathesaurus hierarchy, and visualized in a data matrix on the workstation's display.

From this data matrix, it is possible to query the browser for an explanation of what UMLS concepts have been used while scanning the data, and for what concepts data were found in the record. In addition to this functionality, the user can also ask the browser for a MEDLINE co-occurrence table. Last but not least, it is possible via this data matrix to connect to the Internet Grateful Med server and query the MEDLINE database for those abstracts.

CONCLUSION

This prototype browser gives a good impression of the power of integrating structured computer-based patient records with medical knowledge source servers such as the UMLS. It needs to be investigated what metaphor is best in reviewing patient data in this way and what additional tools would enlarge the browsing facilities for the user: graphical trend overviews, visual comparison techniques, etc.

Not all terms in the computer-based patient record could be mapped one-to-one to UMLS concepts. Many terms have been bound to several UMLS concepts. A problem with this one-to-many binding is the absence of composition rules for the UMLS concepts. E.g. "date of begin of treatment hypertension" has been mapped to the UMLS concepts "time", "treatment", and "hypertension" without making explicit the relationships between these concepts.

The semantic relations of the Semantic Network are potential relations and not defined between individual UMLS concepts, but between classes of concepts ("semantic types"). For instance, the relation "treats" holds between the semantic types "Diseases" and "Drugs". Subdivision of semantic types would improve the clinical usability of the semantic network.

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